PENTAIR

KEYSTONE

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1. Optional module 9: Profibus DPV1 interface

The OM9 Profibus DPV1 interface is an electronic module that allows you to connect the Keystone EPI$_2$ electrical actuator to a Profibus DP network. The module has its own microprocessor and control program. It works as a pure bus interface and does not affect the actuator control integrity. It is installed inside the actuator housing and takes the electrical power from the actuator power supply module. The RS 485 interface is located on the module board. The Profibus network is fully isolated from the actuator electronics.
The OM9 Profibus DPV1 is designed to support Profibus DPV0 cyclic communication and acyclic communication as per Profibus DPV1 extension.
For details about EPI$_2$ actuator the reference manual is:
EPI$_2$ Quarter-turn Electric Actuator IOM.

Important

For decommissioning instructions, please refer to the relevant chapter in the EPI$_2$ manual ref. EBPRM-0091.

Warning

EPI$_2$ actuator must be electrically isolated before any disassembling or reassembling operations. Before any disassembling or reassembling operations, please follow in detail the relevant paragraph of the basic installation and operating manual (latest revision available).

Warning

The electronic parts of the EPI$_2$ actuators and all option modules can be damaged by a discharge of static electricity. Before you start, touch a grounded metal surface to discharge any static electricity.

Warning

It is assumed that the installation, configuration, commissioning, maintenance and repair works are carried out by qualified personnel and checked by responsible specialists.

Warning

Repair work, other than operations outlined in this manual, is strictly reserved to qualified Pentair personnel or to personnel authorized by the company itself.

Note:
Based on the Wiring Diagram printed on the board (I.E. DE5687R00E or DE5687R00G and subsequent), the board may have a soldered jumper or a dip switch on the Profibus Termination. Please read the manual for the relevant description.

Fig. 1a: DE5687R00E

Fig. 1b DE5687R00G

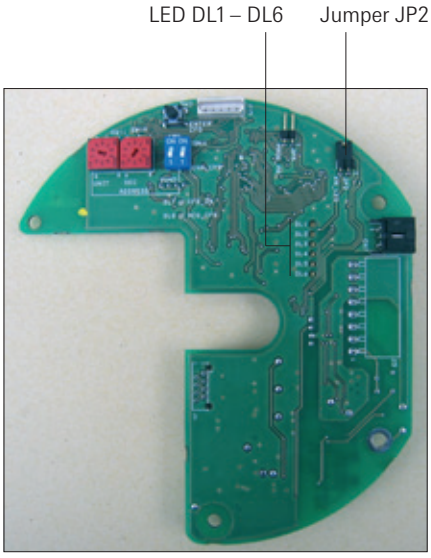
2. Operation and storage

The module is designed to work and to be stored in the same environment as the actuator.

3. Communication features

Communication protocol	Profibus DP according to EN 50170							
Network topology	Line (bus) structure. With repeaters tree structures can also be realized							
Transmission medium	Twisted, screened copper cable according to EN 50170							
Data rate	9.6	19.2	45.45	93.75	187.5	500	1500	Kbit/sec
Cable length without repeater	1200	1200	1200	1200	1000	400	200	m
Approx. cable length with repeater	10	10	10	10	6	4	2	Km
Station type	DPV0 and DPV1 slave							
Device number	32 devices per segment without repeater (max 126, with repeaters)							
Bus access	Token-passing between masters and polling for slaves							
Electrical power	Actuator powered							
Bus termination	Available on board via soldering pad							
Temperature	-40°C, +85°C							
EMC protections	EN 50081-2 and EN 50082-2							
Types of operation	Cyclic data exchange, sync mode, freeze mode, fail safe mode							
Baud rate	Automatic recognition							
Addressing	Configurable via on board rotary BCD switches							

4. EPI$_2$ DPV1 interface



The module consists of a single PCB that is installed inside the actuator housing. It is connected to the EPI$_2$ base card via a flat cable. The internal wiring connects the Profibus data lines to the actuator terminal board.

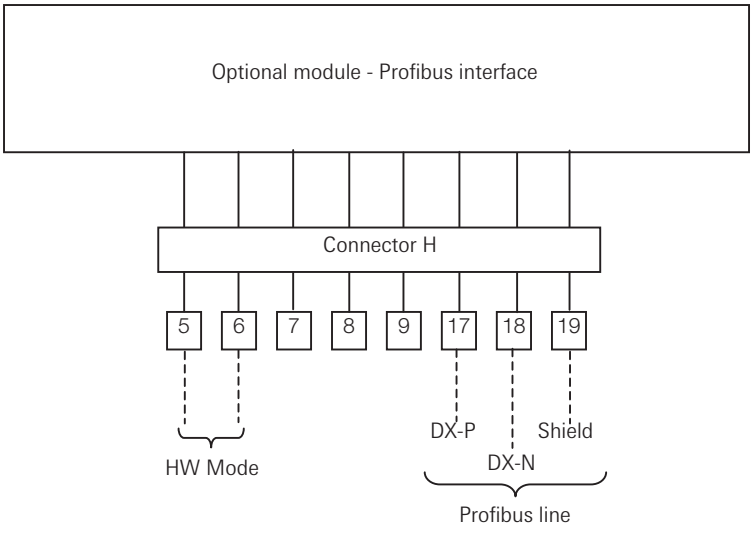
4.1 On board indication

Six LED's are mounted on the EPI$_2$ DPV1 interface to give the following indications for Field service. LED's indications are active only when jumper JP2 is closed.

DL1 (red)	Internal comm. error:	ON when the internal communication of the interface card is not working properly. OFF when the all communication is correct.
DL2 (red)	Fail safe action in progress:	ON when a fail safe action is in progress due to a communication fault on the Profibus line. OFF when the Profibus communication is correct.
DL3 (green)	Slave ready:	ON when the interface is ready to communicate to the Profibus line. OFF when the interface is not ready.
DL4 (green)	Reserved	
DL5 (green)	Profibus:	ON when Profibus communication has been established and the interface has entered in DATA_EX state.
DL6 (green)	Power:	ON when the interface is correctly powered.

4.2 Wiring diagram

The EPI$_2$ DPV1 interface is connected to the actuator terminal board as shown in the figure below:



4.3 Profibus/hardwired mode selection

The EPI$_2$ DPV1 interface manages the Profibus/hardwired mode selection by means of the input indicated with HW MODE. The physical input accepts any voltage from 24 to 125 V DC or AC, polarity insensitive.

When no voltage is applied, the actuator is Profibus controlled and it is possible to send commands and read the status by Profibus DP.

When an appropriate voltage is applied to the HW MODE input, the actuator runs under hardwired control. In this condition the Profibus master can only read the actuator status, while the actuator follows the hardwired Open and Close controls connected to the terminal board.

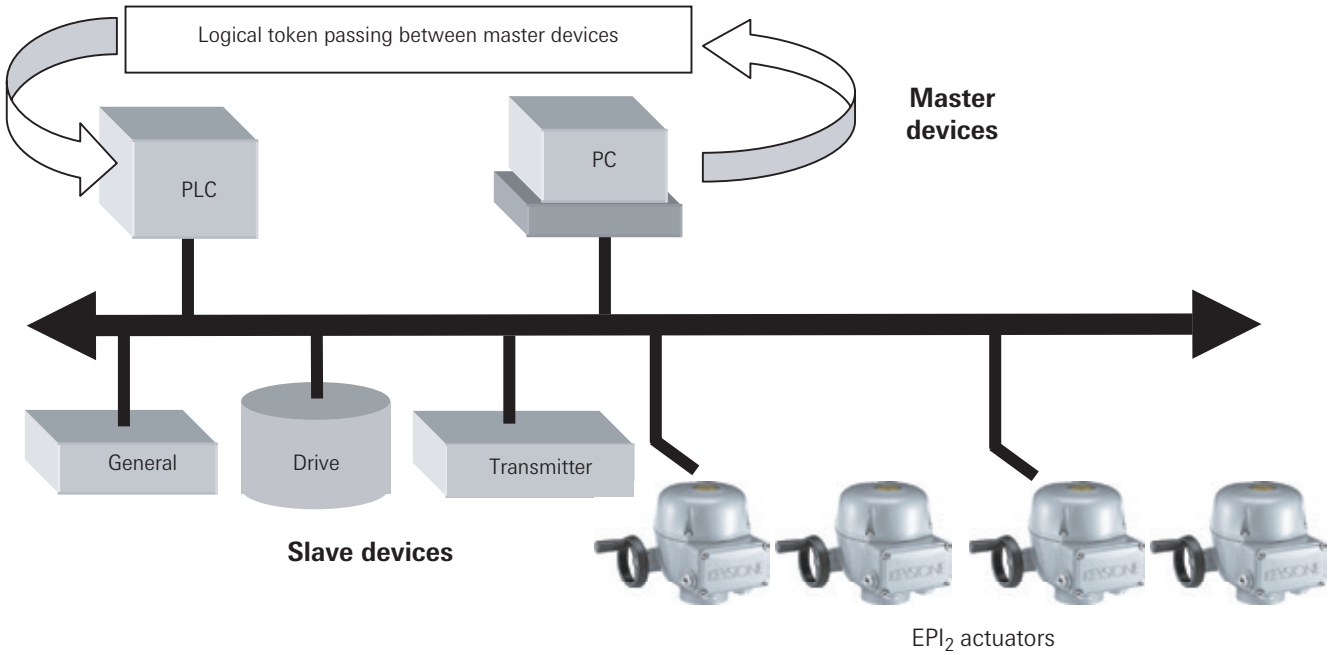
For further details see the relevant wiring diagram and the user manual:
EPI$_2$ Quarter-turn Electric Actuator IOM.

5. Profibus DP description

Profibus is a vendor-independent, open fieldbus standard used in a wide range of applications in process automation. Vendor independence and openness are ensured by the international standards EN 50170 and EN 50254. The DP communication profile is designed for data exchange at the field level. The central controllers (i.e. PLC) communicate via a serial connection with field devices (as sensors and actuators). Data exchange is mainly cyclic. The central controller (called master) cyclically reads the input information from the field devices (called slaves) and cyclically writes the output information to the slaves. In addition the Profibus DP provides communication services for parameterization, alarm handling, and monitoring of intelligent field devices. The maximum number of master and slave devices in a bus segment is 32 without repeaters. With repeaters the number can be extended to 126 on one bus. The maximum cable length depends on the speed of transmission. The higher the speed, the shorter is the length. For instance, with baud rate 93.75 Kb/sec, the max cable length is 1,200 m without repeaters and 10,000 m with repeaters. Mono-master or multi-master system configuration can be provided. Bus access is controlled by a token passing procedure between masters and polling (master-slave procedure) between master and slaves.

DP master class 1 (DPM 1):	This is the central controller that cyclically exchanges information with the field devices. Typical devices are PLC, DCS or PC.
DP master class 2 (DPM 2):	These devices are necessary for commissioning, maintenance and diagnostics.
Slave:	Field device, i.e. transmitters, actuators, drives, etc.

The figure below shows a Profibus DP configuration with two master devices and different slave devices.



6. RS485 transmission mode

The EPI_2 DPV1 interface uses a half duplex, multidrop, serial RS485 communication line. The module communicates with the masters via its RS485 interface and the transmission media consists of a shielded twisted pair cable. Transmission speed from 9.6 kbit/sec to 1.5 Mbit/sec is available. One unique transmission speed is allowed for all devices on the bus when the system is running.
All devices are connected in a bus structure. Up to 32 station (master and slaves) can be connected in one segment without repeaters. Repeaters can be used to extend the number of devices up to 126 and to link the individual bus segment in order to enlarge the network area. The following table shows the relationship between baud rate, segment length and total bus length.

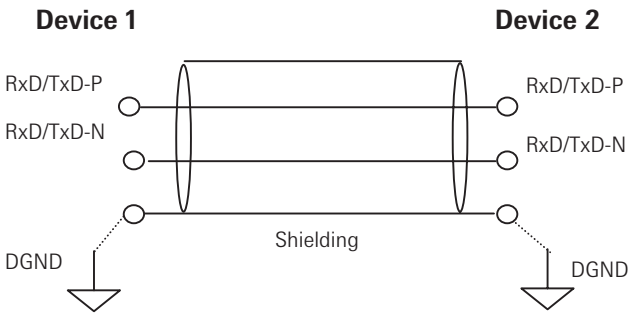
Baud rate	Max. segment length (no repeater)	Max. bus length with 9 repeater
9.6 K	1,200 m	10,000 m
19.2 K	1,200 m	10,000 m
45.45 K	1,200 m	10,000 m
93.75 K	1,200 m	10,000 m
187.5 K	1,000 m	6,000 m
500 K	400 m	4,000 m
1500 K	200 m	2,000 m

The bus must be terminated by an active bus terminator at the beginning and at the end of each segment. Only two terminators in one bus segment must be provided. To ensure error-free operation, both bus terminators must be powered. The maximum cable length depends on the transmission speed. Cable lengths indicated in table 2 are based on Type A cable, as specified by the EN 50170, having the following characteristics.

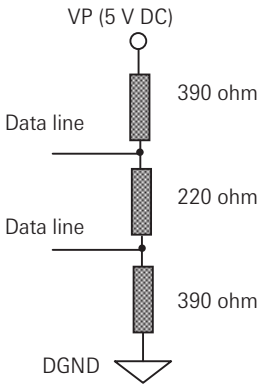
- Impedance from 135 to 165 ohm
- Capacity < 30 pF/m
- Loop resistance 110 ohm/km
- Wire gauge 0.64 mm
- Conductor area > 0.34 mm^2

The use of cable of previously used type B is not recommended.

The data lines must not be reversed. Use of shielded cable is mandatory for having high system immunity against electromagnetic disturbs. The shield should be connected to ground on both sides. The data lines should be kept separate from all other cables. It should be laid in separate, conductive and earthed cable trunking. It must be ensured that there are not voltage differences between individual nodes of Profibus DP.



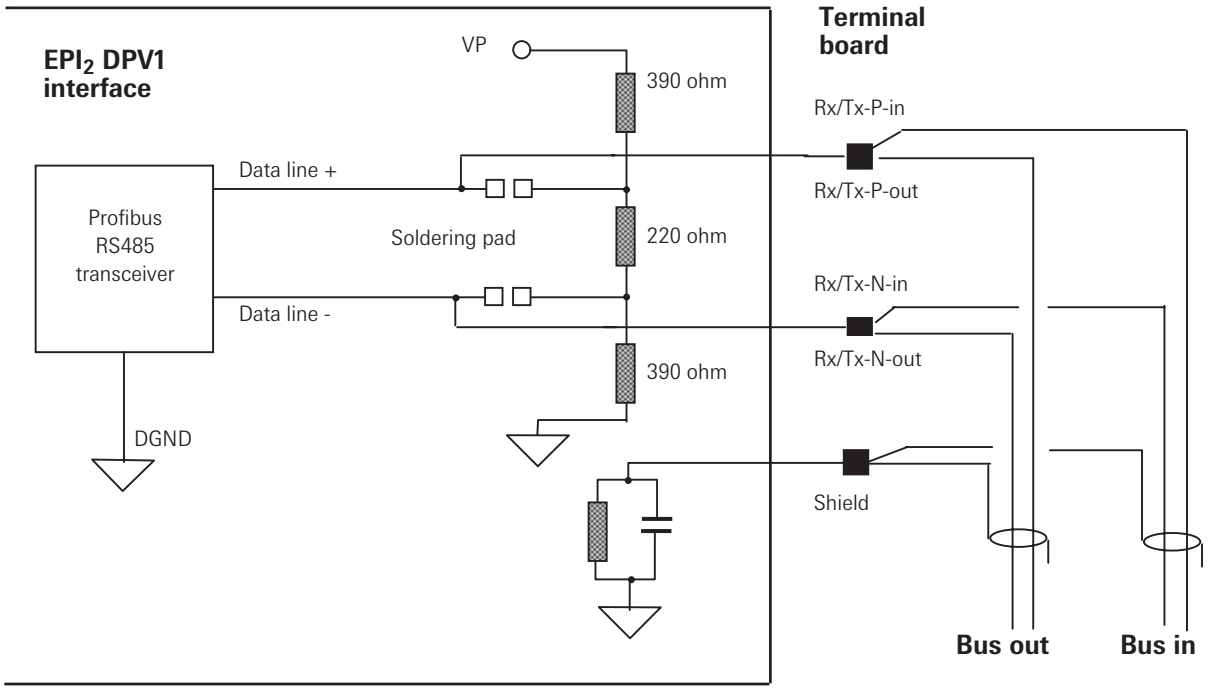
Cable

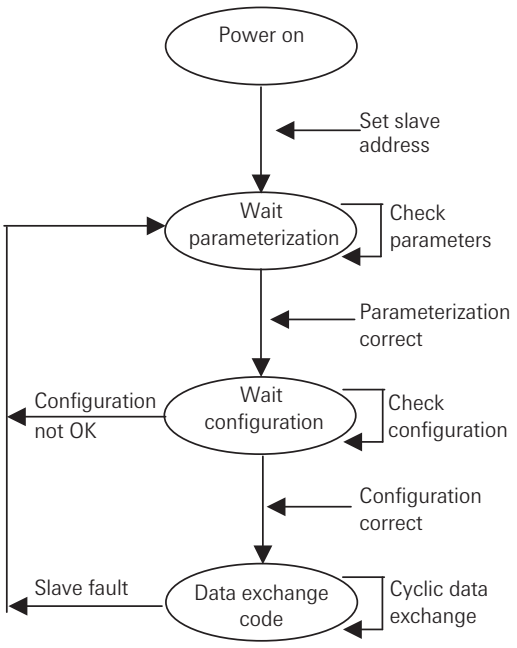


Bus terminator

The EPI$_2$ DPV1 interface takes its electrical supply from the actuator power supply module. The RS485 bus transceiver is isolated from the actuator electronics. Also the voltage supply of the bus termination is isolated.
The bus termination is a crucial component to ensure error-free operation: since the Profibus terminations are active circuits it is important that they remain powered also when a part of the field is powered off. Normal practice recommends to use external terminations available on the market and to power them by a separate, safe power supply.
The EPI$_2$ DPV1 interface is equipped with an on-board bus termination that can be used when the actuator is at the beginning or at the end of the bus segment. If the on-board termination is used, it is not possible to use external termination as well. The bus termination can be connected on the data lines by means of a soldering pad.

The figure below shows the typical Profibus wiring. The termination must be linked to the data lines only if the actuator is at the beginning or at the end of the bus segment.





7. EPI$_2$ DPV1 interface power-up

On power-up the module checks the baud rate and then waits for the 'parameterization' telegram from the master. The parameterization message contains user information needed for actuator operation and is listed in chapter 8: Data exchange during parameterization'.
After parameterization the module waits for the 'configuration' telegram from the master. The configuration message contains the number of input and output bytes reserved in the memory of the master device for each slave. Only the number of bytes determined in the configuration is transmitted between master and slave. This information is called 'module'. The EPI$_2$ DPV1 board implements the following modules:

- Module 1 : 1 byte output; 2 bytes input
- Module 2 : 4 byte output; 6 bytes input
- Module 3 : 1 byte output; 2 bytes input - consistent
- Module 4 : 4 byte output; 6 bytes input - consistent

Consistent is an attribute that specify the capability of the module to maintains data consistency over the entire data length. In this way the data will not change during the reading by the Profibus DP-Master.
For example, if module 2 is selected, the output telegram consists in 4 bytes, and the input telegram in 6 bytes.

When parameters and configuration are correct, the module enters in 'data exchange mode' and starts with normal operation. The master cyclically sends commands to the slave and read its status.
The figure on the left shows the power-up flow diagram of a DP slave.

8. Data exchange during parameterization

The following data is sent to the EPI$_2$ DPV1 interface:

Byte	Name	Type	Range	EU	Default
0	Reserved DPV1				
1	Reserved DPV1				
2	Reserved DPV1				
3	Fail safe action	1 byte	0 1 2 3 4	Off Close Open Stay put Go to position	Off
4	Storage format	1 byte	0 1	LSB first MSB first	LSB first MSB first
5	Delay before initiating safe operation	1 byte	0-10	sec	4
6	Safe position	1 byte	0-100	%	50
7	Dead band	1 byte	3-20	Tenth of %	15
8	Closing direction	1 byte	0 1	CW CCW	CW
9	Opening speed set	1 byte	0 … 9	Min … Max	7
10	Closing speed set	1 byte	0 … 9	Min … Max	7
11	Opening torque set	1 byte	0 … 9	Min … Max	9
12	Closing torque set	1 byte	0 … 9	Min … Max	9
13	Open limit	1 byte	0 1	By torque By position	By position
14	Close limit	1 byte	0 1	By torque By position	By position
15	LED color code	1 byte	0 1	OP green - CL red OP red - CL green	Green LED lit in fully open position

It should be noticed that every time that Profibus communication is established, the parameterization string will be sent to the device writing the parameters to the set up values. The values in parameterization string shall be modified at the Master station.

Byte 0-2 Reserved for DPV1

Byte 3 Storage format

This byte defines the format of the variables that are transmitted on 2 or 4 bytes. The setting of this parameter affects the format of the following data:

Output data:	(if module 2 is selected)	Set point
Input data:	(if module 2 is selected)	Current position
General data:	Slot 1 index 1	Current position

Value: 0: LSB byte is transmitted first (default setting)
1: MSB byte is transmitted first

Byte 4 Fail safe action

This byte defines the action of the actuator in case of loss of signal. The action takes place only if the local selector is on Remote position and if the bus is operating. When the bus signal restores, also the actuator restores at its normal functioning.

Value: 0: Off - disable (default setting)
1: Close
2: Open
3: Stay put
4: Go to position indicated in the parameter ‘safe position’

IMPORTANT: Fail safe action is active only if watchdog control is enabled.

Byte 5 **Delay before initiating fail safe operation**
This byte defines the delay before execution of the programmed safe action
Value: minimum 0 sec.
maximum 10 sec.
default value: 4 sec.

Byte 6 **Safe position**
This byte defines the safe position when 'fail safe action: go to position' is selected
Value: minimum 0%
maximum 100%
default value: 50%

Byte 7 **Dead band**
This byte defines in tenth of % the dead band of the positioning function available on the modulating actuator. The movement is inhibited until the difference between current position and requested position (position error) is lower than dead band.
Value: minimum 3 = 0,3%
maximum 20 = 2,0%
default value: 15 = 1,5%

Byte 8 **Closing direction**
This byte defines the closing direction of the motor
Value: 0: CW – clockwise (default value)
1: CCW – counter clockwise

Byte 9 **Opening speed set**
This byte defines the speed of the motor when opening
Value: minimum 0
maximum 9
default value: 7

Byte 10 **Closing speed set**
This byte defines the speed of the motor when closing
Value: minimum 0
maximum 9
default value: 7

Byte 11 **Opening torque set**
This byte defines the opening torque
Value: minimum 0 = 40% of nominal torque
maximum 9 = 100% of nominal torque
default value: 9

Byte 12 **Closing torque set**
This byte defines the closing torque
Value: minimum 0 = 40% of nominal torque
maximum 9 = 100% of nominal torque
default value: 9

Byte 13 **Open limit**
This byte defines the end of travel setting in open direction
Value: 0: by torque
1: by position (default setting)

Byte 14 **Close limit**
This byte defines the end of travel setting in close direction
Value: 0: by torque
1: by position (default setting)

Byte 15 **LED color code**
This byte defines the color of the LED indicating the fully open and fully close position as the optional local panel
Value: 0: Open: LED = green; Close: LED = red (default setting)
1: Open: LED = red; Close: LED = green

9. Data exchange mode

The following paragraph describes the input and output messages of EPI_2 DPV1 interface when working in 'data exchange mode' for 'cyclic data' and 'acyclic data'. In all cases it is called 'input signal' if data is sent from actuator to bus, vice-versa it is called 'output signal'.

9.1 Cyclic communications DPV0

9.1.1 Output data

The structure of cyclic output data is as follow depending on the module selected:

Module 1 or Module 3

Byte	b7	b6	b5	b4	b3	b2	b1	b0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Stop command	Close command	Open command

Module 2 or Module 4

Byte	b7	b6	b5	b4	b3	b2	b1	b0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Stop command	Close command	Open command
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Positioner enable
2				Set point				
3				Set point				

Command	Description	Position
Open command	When this bit is set to 1 an open command is issued to the actuator. The open command is maintained for all the duration on the movement since the receiving of the bus command until the open limit has been reached. The open command is reset when a stop command is received from the bus.	Associated to output data Module 1/3 or Module 2/4 Byte 0; bit 0
Close command	When this bit is set to 1 a close command is issued to the actuator. The close command is maintained for all the duration on the movement since the receiving of the bus command until the close limit has been reached. The close command is reset when a stop command is received from bus.	Associated to output data Module 1/3 or Module 2/4 Byte 0; bit 1
Stop command	When this bit is set to 1 a stop command is issued to the actuator. The stop command received from the bus causes the reset of both open and close command.	Associated to output data Module 1/3 or Module 2/4 Byte 0; bit 2
Positioner enable	When this bit is set to 1 it enables the on-board positioner. The positioner is enabled as long as this bit is set to 1.	Associated to Module 2/4 Byte 1; bit 0
Set point	The set point received from the bus is used to produce the open or close commands to the EPI_2 actuator as defined in paragraph 9.1.3: 'Positioning algorithm'.	Associated to output data Module 2/4 Byte 2 and 3

9.1.2 Input data

The structure of the cyclic input data is defined depending on the module selected:

Module 1 or Module 3

Byte	b7	b6	b5	b4	b3	b2	b1	b0
0	Monitor relay	Intermediate position	Motor stopped	Fully closed	Actuator moving	Closing	Opening	Fully open
1	Reserved	Reserved	Reserved	Reserved	Local configuration	Remote	Local	Hardwired mode

Module 2 or Module 4

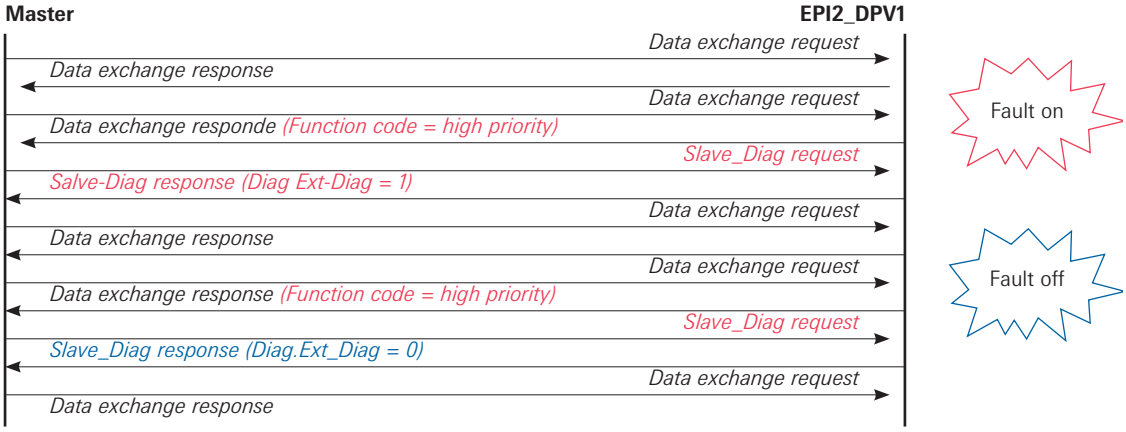
Byte	b7	b6	b5	b4	b3	b2	b1	b0
0	Monitor relay	Intermediate position	Motor stopped	Fully closed	Actuator moving	Closing	Opening	Fully open
1	Reserved	Reserved	Reserved	Reserved	Local configuration	Remote	Local	Hardwired mode
2	Current position							
3	Current position							
4	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Positioner active
5	Current torque							

Command	Description	Position
Fully open	The fully open indication is set to 1 when the EPI$_2$ actuator is at fully open position. This indication reflects the status of the open limit on the EPI$_2$ actuator.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 0
Opening	The opening indication is set to 1 when the EPI$_2$ actuator is moving towards the open direction.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 1
Closing	The closing indication is set to 1 when the EPI$_2$ actuator is moving towards the close direction.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 2
Actuator moving	This indication is set to 1 when the actuator is moving either in opening or in closing direction.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 3
Fully close	The fully close indication is set to 1 when the EPI$_2$ actuator is at fully close position. This indication reflects the status of the close limit on the EPI$_2$ actuator.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 4
Motor stopped	This indication is set to 1 when the actuator is not moving and the motor has stopped.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 5
Intermediate position	This indication is set to 1 when the valve is on an intermediate position.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 6
Monitor relay	This indication is set to 1 when the actuator is available for bus control. Monitor relay indication means that the local selector is on remote position and no alarms are present.	Associated to input data Module 1/3 or Module 2/4, Byte 0; bit 7
Hardwired mode	This indication is set to 1 when the hardwired mode is selected.	Associated to input data Module 1/3 or Module 2/4, Byte 1; bit 0
Local	This indication is set to 1 when the optional local selector is set on local position to enable open/close local command.	Associated to input data Module 1/3 or Module 2/4, Byte 1; bit 1
Remote	This indication is set to 1 when the EPI$_2$ actuator is not equipped with the optional local selector or when local selector is set on remote position to enable remote commands.	Associated to input data Module 1/3 or Module 2/4, Byte 1; bit 2
Local configuration	This indication is set to 1 when a local configuration in progress.	Associated to input data Module 1/3 or Module 2/4, Byte 1; bit 3
Current position	The current position read from the base card.	Associated to input data Module 2/4, Byte 2 and 3
Positioner active	This indication is set to 1 when the on-board positioner is enabled.	Associated to input data Module 2/4, Byte 4; bit 0
Current torque	The current torque read from the base card.	Associated to input data Module 2/4, Byte 5

9.1.3 Positioning algorithm
A positioning algorithm (position closed loop control) is implemented on the EPI$_2$ DPV1 interface card.
Positioning function compares the position, received from the base card, with the position request received from the bus. If the difference between 'position request and present position' is greater than the 'dead band' an open or a close command is sent to the base card. Dead band is configurable via bus from 0,3 to 2,0%.

9.1.4 Diagnostic message
The EPI$_2$ DPV1 interface manages the diagnostic indication coming from the actuator as stated by the Profibus DP V1 standard.

When the EPI$_2$ DPV1 interface needs to notify a fault to the master while in data exchange mode, it changes the function code in its response message to 'high priority'. During the next regular bus cycle the master in turn send a 'Slave_Diag' request that is answered with a 'Slave_Diag' response. The availability of specific diagnosis information is notified by Dia.Ext_Diag flag set to 1. Once the master was able to catch the diagnosis information it returns to the standard cyclic data exchange mode. To notify the termination of the diagnosis incident the EPI2_DPV1 interface send a 'high priority' response. The master answers with a 'Slave_Diag' request that is followed by a 'Slave_ Diag' response with Dia.Ext_Diag flag set to 0.



The diagnostic message implemented by EPI2_DPV1 has the following structure:

MS LSB

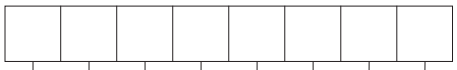
Octet 1	**Standard diagnostic block** 6 octets
Octet 2	
Octet 3	
Octet 4	
Octet 5	
Octet 6	

Type **IRD**, length	**Identifier related diagnostic block**
0 0 0 0 a a a a	2 Octets

Type **DRD**, Lenght	**Device related diagnostic block** **Status messages** 6 octets
Identifier, Status_Type	
Slot_Number	
Status_Specifier	
d d d d d d d d	
d d d d d d d d	

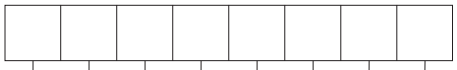
Standard diagnostic block

Octet 1 Bit0



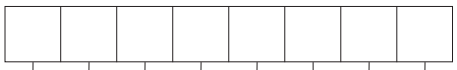
Diag_Station_Non_Existent	(1) = Slave does not exist (sets master)
Diag_Station_Not_Ready	(1) = Slave not ready for data exchange
Diag_Cfg_Fault	(1) = Slave has mismatching configuration data
Diag_Ext_Diag	(0) = Slave sends standard diagnosis data only (6 bytes) or with extended diagnosis without fault (i.e. when the fault condition disappears)
Diag_Not_Supported	(1) = Slave does not support the required function
Diag_Invalid_Slave_Response	(0) = Set by slave (1) = Set by master in case of fault
Diag.Prm_Fault	(1) = Incorrect parameterization
Diag.Master_Lock	(1) = Slave has been parameterized by a different master (sets master)

Octet 2 Bit0



Diag.Pm_Req	(1) = Slave has to be re-parameterized
Diag.Stat_Diag	(1) = During start-up phase slave not able to provide valid diagnosis data
DP	(1) = Fixed at 1
Diag.WD_On	(1) = Threshold monitoring activated
Diag.Freeze_Mode	(1) = FREEZE command received
Diag.Sync_Mode	(1) = SYNC command received
reserved	
Diag.Deactivated	(1) = Diagnosis deactivated (sets master)

Octet 3 Bit0

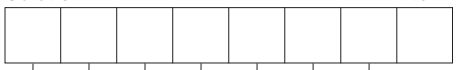


reserved	
Diag.Ext_Diag_Overflow	(1) = Slave has more diagnosis data than fit into the buffer

Octet 4 Bit0

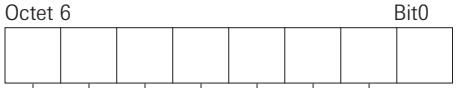
Diag_Master_Add	Address of the master that has parameterized the slave 0xFF when slave not parameterized yet

Octet 5 Bit0



Ident_Number	High byte of the slave's ident number. EPI2_DPV1 report 0x09

Octet 6 Bit0



Ident_Number	Low byte of the slave's ident number, EPI2_DPV1 report 0xE3

Identifier related diagnosis block

Octet 7 — Bit0

0	1						

Header: EPI2_DPV1 report **0x42** — Low byte of the slave's ident number, EPI2_DPV1 report 0xE3

Block_Lenght — Number of octets of this block including this header

Selection — (01) = Identifier Related Diagnostic

Octet 8 — Bit0

0	0	0	0				

Identifier_Diagnosis_Data_Array

Identifier_Diagnosis_Entry_1 — (0) = Module 1 has no diagnosis data (1) = Module 1 has diagnosis data

Identifier_Diagnosis_Entry_2 — (0) = Module 2 has no diagnosis data (1) = Module 2 has diagnosis data

Identifier_Diagnosis_Entry_3 — (0) = Module 3 has no diagnosis data (1) = Module 3 has diagnosis data

Identifier_Diagnosis_Entry_4 — (0) = Module 4 has no diagnosis data (1) = Module 4 has diagnosis data

Padding bits

Octet 9 — Bit0

0	0						

Header: EPI2_DPV1 report **0x06**

Block_Lenght — Number of octets of this block including this header

Selection — (00) = Device Related Diagnostic

Octet 10 — Bit0

1	0	0	0	0	0	0	1

Status: EPI2_DPV1 report **0x81**

Status_Type — (1) = Status_Message

Identifier — (1) = Status

Octet 11 — Bit0

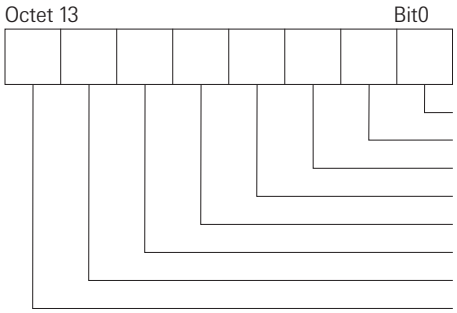
0	0	0	0	0	0	0	0

Slot_Number: EPI2_DPV1 report **0x00**

Octet 12 — Bit0

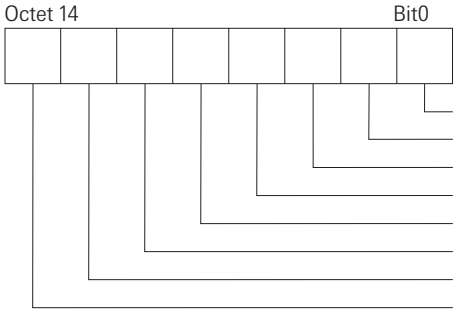
0	0	0	0	0	0	0	0

Status_Specifier: EPI2_DPV1 r**eport 0x00**



Status_Data_Description

(1) = Not Operative in Open Direction
(1) = Not Operative in Close Direction
(1) = Power Fail Alarm
(1) = HI-HI Torque in Opening
(1) = HI-HI Torque in Closing
(1) = Stroke Limit Alarm
(1) = Alarm on Optional Control Card (Pushbutton)
(1) = Motor direction Alarm



Status_Data_Description

(1) = Jammed valve
(1) = Hardware error
(1) = Position Sensor Failure
(1) = HI-HI Temperature
(1) = Local Configuration in Progress
(1) = Reserved
(1) = Reserved
(1) = Reserved

The meaning of every diagnosis event listed in the extended diagnostic block is documented in the GSD file where to each bit corresponds a specific text to describe the device related diagnosis.
A full Profibus DP compliant master should be able to show the correspondent text in the event of a diagnostic message.

- **Not Operative in Open direction**
  This bit is set when the open commands are not available due to current alarm trip in open direction.
  The diagnostic indication is cleared when the alarm that has generated the fault disappears.
- **Not Operative in Close direction**
  This bit is set when the close commands are not available due to current alarm trip in close direction.
  The diagnostic indication is cleared when the alarm that has generated the fault disappears.
- **Power Failure Alarm**
  This bit is set when the main supply is not in the proper range.
  The diagnostic indication is cleared at the next power up if the power supply is corrected.
- **HI-HI Torque in Opening**
  This bit is set when the torque has reached the programmed limit while the actuator was moving in opening direction.
  The diagnostic indication is cleared by a close command.
- **HI-HI Torque in Closing**
  This bit is set when the torque has reached the programmed limit while the actuator was moving in closing direction.
  The diagnostic indication is cleared by an open command.
- **Stroke Limit Alarm**
  This bit is set when the current position is behind the open or close limit switches or as result of an incorrect torque set..
  The diagnostic indication is cleared when the position returns within the limits or after a successful torque configuration procedure.
- **Alarm on Optional Local Control (Pushbutton)**
  This bit is set when the optional local control does not work correctly.
  The diagnostic indication is cleared when the local control works without problems.
- **Motor Direction Alarm**
  This bit is set when the motor drive has recognised an incorrect behaviour.
  The diagnostic indication is cleared by a command in the opposite direction.
- **Jammed Valve**
  This bit is set when the actuator detects a jammed valve condition.
  The diagnostic indication is cleared by a command in the opposite direction.
- **Hardware Error**
  This bit is set when the actuator detects a general hardware error.
  The diagnostic indication is cleared at the next power up under normal condition.
- **Position Sensor Failure**
  This bit is set when the actuator detects that executing a command the position sensor is not working properly.
  The diagnostic indication is cleared by a command in the opposite direction.
- **HI-HI Temperature**
  This bit is set when the internal temperature is out from the operational limits.
  The diagnostic indication is cleared when the internal is within the limits.
- **Local Configuration in Progress**
  This bit is set when the actuator detects that a local operator is executing a local configuration.
  The diagnostic indication is cleared when the local operator finishes the configuration and the actuator returns to normal operations.

9.2 Acyclic communication DPV1

This paragraph defines the composition of the acyclic communication defined as per Profibus DPV1 standard.
The data available on acyclic communication is organized as shown in the following table:

Slot	Index	length	Access	Description
Slot 0: Name plate data				
0	0	12 bytes	Read only	Actuator serial number
0	1	12 bytes	Read only	Actuator type
0	2	12 bytes	Read only	Valve tag name
0	3	28 bytes	Read only	Profibus interface
Slot 1: General data				
1	0	3 bytes	Read only	General data about current working condition
1	1	3 bytes	Read only	Position and torque
1	2	1 byte	Read only	temperature
Slot 2: Actuator configuration data				
2	0	4 bytes	Read and write	Torque and speed set
2	1	1 byte	Read and write	Dead band
2	2	6 bytes	Read only	General configuration
2	3	3 bytes	Read only	Fail safe

9.2.1 Name plate

Byte	Name	Dim	Range	EU
Slot 0, Index 0, length 12 bytes - Only read: Actuator serial number				
0-11	Actuator serial number	12 bytes		String
Slot 0, Index 1, length 12 bytes - Only read: Actuator type				
0-11	Actuator type	12 bytes		String
Slot 0, Index 2, length 12 bytes - Only read: Valve tag name				
0-11	Valve tag	12 bytes		String
Slot 0, Index 3, length 28 bytes - Only read: Profibus interface				
0-19	Model name	20 bytes		String
20-23	Firmware revision	4 bytes		String
24-27	Hardware revision	4 bytes		String

9.2.2 General data

Slot 1, Index 0, length 3 bytes - Read only: General data about current working condition

Byte	Name	bit	Description
0	Byte 0	0	Fully open position
		1	Opening
		2	Closing
		3	Actuator moving
		4	Fully close
		5	Motor stopped
		6	Intermediate position
		7	Monitor relay
1	Byte 1	0	Hardwired mode
		1	Local control
		2	Remote control
		3	Local configuration
		4	
		5	
		6	
		7	
2	Byte 2	0	Positioner active
		1	
		2	
		3	
		4	
		5	
		6	
		7	

Byte	Name	Dim	Range	EU
Slot 1, Index 1, length 3 bytes - Only read: Position and torque				
0-1	Current position	2 bytes	0 - 1000	0,1%
2	Current torque	1 byte	0 - 100	%
Slot 1, Index 2, length 1 byte - Only read: Temperature				
0	Internal temperature	1 byte	-128 +127	°C

9.2.3 Actuator configuration

Byte	Name	Dim	Range	EU
Slot 2, Index 0, length 4 bytes – Read and write: Torque and speed set				
0	Opening speed set	1 byte	0	Min
			…	…
			9	Max
1	Closing speed set	1 byte	0	Min
			…	…
			9	Max
2	Opening torque set	1 byte	0	Min
			…	…
			9	Max
3	Closing torque set	1 byte	0	Min
			…	…
			9	Max
Slot 2, Index 1, length 1 byte – Read and write: Dead band				
0	Dead band	1 byte	3-20	Tenth of %
Slot 2, Index 2, length 6 bytes – Only read: General configuration				
0	Storage format	1 byte	0	LSB first
		1	1	MSB first
1	Closing direction	1 byte	0	CW
			1	CCW
2	Open limit	1 byte	0	By torque
			1	By position
3	Close limit	1 byte	0	By torque
			1	By position
4	Nominal torque	1 byte	0	63 Nm
			1	125 Nm
			2	250 Nm
			3	500 Nm
			4	1000 Nm
			5	2000 Nm
5	LED color code	1 byte	0	OP green - CL red
			1	OP red - CL green

Byte	Name	Dim	Range	EU
Slot 2, Index 3, length 3 bytes - Read only: Fail safe				
0	Fail safe action	1 byte	0	Off
			1	Open
			2	Close
			3	Stay put
			4	Go to position
1	Delay before initiating safe oper.	1 byte	0-10	sec
2	Safe position	1 byte	0-100	%

10. Local settings

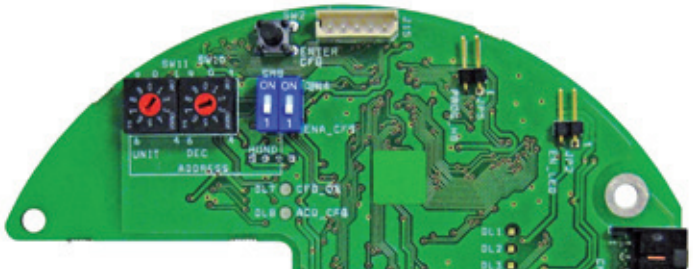
The EPI$_2$ DPV1 board is equipped with a set of switches to allow the operator to configure the Profibus address.
Furthermore two soldering pads are available to connect the Profibus termination circuit to be used in case that the external termination is not available.

To perform the local setting on the EPI$_2$ DPV1 board, it is necessary to follow carefully the procedures explained in the EPI$_2$ quarter-turn electric actuator IOM at chapter 6: 'Actuator settings and configuration'.

10.1 Profibus address setting

Profibus address is configured by means of the switches indicated in the figure and located on the EPI$_2$ DPV1 interface soldering side, direct accessible when the control unit cover is removed. To enter a new Profibus address the EPI$_2$ actuator needs to be powered.

Fig. 2

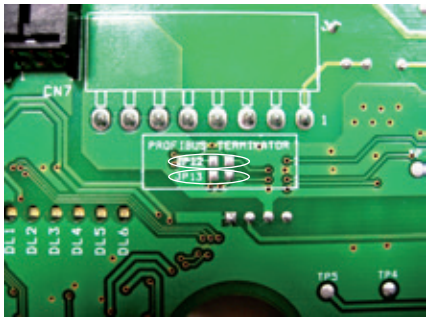


Configuration procedure:

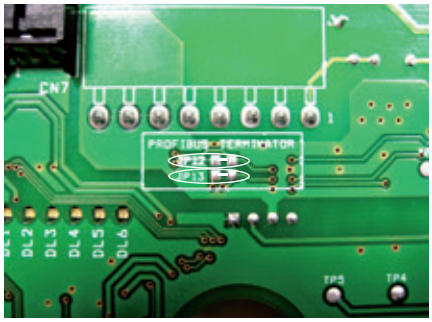
- Move the dip switch ENA-CFG to the ON position: the CFG_ON LED is turned ON to indicate that the actuator is entered in configuration mode
- Set the new Profibus address on the rotary switches UNIT and DEC and on the dip switch HUNDR. E.g. address 028 corresponds to:
  - HUNDR. on OFF position
  - DEC. on position 2
  - UNIT on position 8
- Press the push button ENTER to confirm the new settings: if the new address is correct the ACQ_CFG LED is turned ON
- Move the dip switch CFG_ENA to the OFF position to exit from configuration mode: the CFG_ON LED is turned OFF and the OM9 Profibus DPV1 restarts with the new address. It is not required to power down and start up the actuator.

10.2.a Profibus termination on board code DE5687R00E

On board termination is located on the side of the EPI$_2$ DPV1 module as shown in the photo below. The termination is activated by two soldering paths indicated with JP12 and JP13:



On default the soldering paths are left open and the termination is not active.



To activate the on board termination both the soldering paths must be closed as indicated.

10.2.b Profibus termination on board code DE5687R00G and subsequent

On board termination is done through the dip switch located on the board as shown in the photo below. The termination is activated when the dip switches are in position ON. To remove the termination, please move both the switches to 1.

11. GSD file

```
; GSD-File  for F02 EPI2    Biffi Italia srl
; Author: C.Doglio
; Date:      20.07.05
; File: F02_09E3.GSD    rev.0.0 ;=============================================
==============
; #Profibus_DP
;
; Prm-Text-Def-List:
;
;Text definition 1
PrmText=1
Text(0)='LSB first'
Text(1)='MSB first'
EndPrmText
;
;Text definition 2
PrmText=2
Text(0)='Off'
Text(1)='Close'
Text(2)='Open'
Text(3)='Stayput'
Text(4)='Go to position'
EndPrmText
;
;Text definition 4
PrmText=4
Text(0)='By Torque'
Text(1)='By Position'
EndPrmText
;
;Text definition 5
PrmText=5
Text(0)='GREEN lit when OPEN'
Text(1)='RED lit when OPEN '
EndPrmText
;Text definition 6
PrmText=6
Text(0)='CW'
Text(1)='CCW'
EndPrmText
```

```
;
; Ext-User-Prm-Data-Def-List:
;
ExtUserPrmData=1 'Storage Format'
Unsigned8 0 0-1
Prm_Text_Ref=1
EndExtUserPrmData
ExtUserPrmData=2 'Fail safe action'
Unsigned8 0 0-4
Prm_Text_Ref=2
EndExtUserPrmData
ExtUserPrmData=3 'Fail safe delay'
Unsigned8 4 0-10
EndExtUserPrmData
ExtUserPrmData=4 'Safe position'
Unsigned8 50 0-100
EndExtUserPrmData
ExtUserPrmData=5 'Closing direction'
Unsigned8 0 0-1
Prm_Text_Ref=6
EndExtUserPrmData
ExtUserPrmData=6 'Opening speed set'
Unsigned8 7 0-9
EndExtUserPrmData
ExtUserPrmData=7 'Closing speed set'
Unsigned8 7 0-9
EndExtUserPrmData
ExtUserPrmData=8 'Opening Torque set'
Unsigned8 9 0-9
EndExtUserPrmData
ExtUserPrmData=9 'Closing Torque set'
Unsigned8 9 0-9
EndExtUserPrmData
ExtUserPrmData=10 'Open limit'
Unsigned8 1 0-1
Prm_Text_Ref=4
EndExtUserPrmData
ExtUserPrmData=11 'Close limit'
Unsigned8 1 0-1
Prm_Text_Ref=4
EndExtUserPrmData
ExtUserPrmData=12 'Dead band'
Unsigned8 15 3-20
EndExtUserPrmData
ExtUserPrmData=13 'LED color code'
Unsigned8 0 0-1
Prm_Text_Ref=5
EndExtUserPrmData
;
; Unit definition list:
;
GSD_Revision=4
;
Vendor_Name='Biffi Italia srl'
Model_Name='F02 EPI2 DPV1'
Revision='Release 0.0'
Ident_Number=0x09E3
Protocol_Ident=0
Station_Type=0
Hardware_Release='Hardware Release DE5687 rev.0.0'
Software_Release='Software Release SW=0.00'
;
9.6_supp=1
19.2_supp=1
45.45_supp=1
93.75_supp=1
187.5_supp=1
500_supp=1
1.5M_supp=1
```

```
MaxTsdr_9.6=60
MaxTsdr_19.2=60
MaxTsdr_45.45=60
MaxTsdr_93.75=60
MaxTsdr_187.5=60
MaxTsdr_500=100
MaxTsdr_1.5M=150
;
Implementation_Type='SPC3'
Bitmap_Device='F02k_R'
Bitmap_Diag='F02k _D'
Bitmap_SF='F02 _C'
;
; Slave-Specification:
;
Freeze_Mode_supp=1
Sync_Mode_supp=1
Auto_Baud_supp=1
Set_Slave_Add_supp=0
Min_Slave_Intervall=1
Max_Diag_Data_Len=16
Slave_Family=0
Fail_Safe=1
;
; UserPrmData: Length and Preset:
;
User_Prm_Data_Len=16
User_Prm_Data=0x00,0x00,0x00,\    ;0-2 Reserved DPV1
0x00,  \                          ;3- Storage Format
0x00,  \                          ;4 -Fail Safe action
0x04,  \                          ;5 -Delay before Fail Safe
0x32,  \                          ;6 -Safe position
0x0f,  \                          ;7 -Dead band
0x00,  \                          ;8 -Closing direction
0x07,  \                          ;9 -Opening speed set
0x07,  \                          ;10 -Closing speed set
0x09,  \                          ;11-Opening Torque set
0x09,  \                          ;12-Closing Torque set
0x01,  \                          ;13-Open limit
0x01,  \                          ;14-Close limit
0x00                              ;15-LED color code
;
Max_User_Prm_Data_Len=16
;
Ext_User_Prm_Data_Const(0)=0
Ext_User_Prm_Data_Const(1)=0
Ext_User_Prm_Data_Const(2)=0
Ext_User_Prm_Data_Ref(3)=1
Ext_User_Prm_Data_Ref(4)=2
Ext_User_Prm_Data_Ref(5)=3
Ext_User_Prm_Data_Ref(6)=4
Ext_User_Prm_Data_Ref(7)=12
Ext_User_Prm_Data_Ref(8)=5
Ext_User_Prm_Data_Ref(9)=6
Ext_User_Prm_Data_Ref(10)=7
Ext_User_Prm_Data_Ref(11)=8
Ext_User_Prm_Data_Ref(12)=9
Ext_User_Prm_Data_Ref(13)=10
Ext_User_Prm_Data_Ref(14)=11
Ext_User_Prm_Data_Ref(15)=13
;
;
Modular_Station=1
Max_Module=1
Max_Input_Len=6
Max_Output_Len=4
Max_Data_Len=10
```

```
;
; Slave-Specification:
;
DPV1_Slave=1
;
C1_Read_Write_supp=0
C2_Read_Write_supp=1
C2_Max_Data_Len=240
C2_Response_Timeout=100
C2_Read_Write_required=0
C2_Max_Count_Channels=3
Max_Initiate_PDU_Length=72
Diagnostic_Alarm_supp=0
Process_Alarm_supp=0
Pull_Plug_Alarm_supp=0
Status_Alarm_supp=0
Update_Alarm_supp=0
Manufacturer_Specific_Alarm_supp=0
Extra_Alarm_SAP_supp=0
Alarm_Sequence_Mode_Count=0
Alarm_Type_Mode_supp=0
Diagnostic_Alarm_required=0
Process_Alarm_required=0
Pull_Plug_Alarm_required=0
Status_Alarm_required=0
Update_Alarm_required=0
Manufacturer_Specific_Alarm_required=0
DPV1_Data_Types=0
WD_Base_1ms_supp=1
Check_Cfg_Mode=0
;
;Device related Diagnosis
;
Unit_Diag_Bit(24)='Not Operative Open'
Unit_Diag_Bit(25)='Not Operative Close'
Unit_Diag_Bit(26)='Power Fail Alarm'
Unit_Diag_Bit(27)='HI-HI Torque in Opening'
Unit_Diag_Bit(28)='HI-HI Torque in Closing'
Unit_Diag_Bit(29)='Stroke Limit Alarm'
Unit_Diag_Bit(30)='Local Control Alarm'
Unit_Diag_Bit(31)='Motor Direction Alarm'
Unit_Diag_Bit(32)='Jammed Valve'
Unit_Diag_Bit(33)='Hardware Error'
Unit_Diag_Bit(34)='Postition Sensor Failure'
Unit_Diag_Bit(35)='HI-HI Temperature'
Unit_Diag_Bit(36)='Local Configuration in progress'
;
; Module Definition List
;
Module='Mod.1: 2 B.In, 1 B.Out' 0x11,0x20 1
EndModule
Module='Mod.2: 6 B.In, 4 B.Out' 0x15,0x23 2
EndModule
Module='Mod.3: 2 B.In, 1 B.Out - Cons.' 0x91,0x20 3
EndModule
Module='Mod.4: 6 B.In, 4 B.Out - Cons.' 0x95,0xa3 4
EndModule
```

12. Bluetooth communication module

The OM9 module is provided with integrated Bluetooth module. In www.biffi.it you can download A-Manager program to modify each settings by integrated Bluetooth module. After installation of A-Manager program, please clic on 'Operations'button and then clic on 'Bluetooth Control'button and tick 'on'.
The features and functionalities performed with Bluetooth module are indicated in A-Manager IOM for PDA (BIFCS-0029) and PC (BIFCS-0028).

13. Profibus certificate

Certificate

PROFIBUS Nutzerorganisation e.V. grants to

Biffi Italia srl
Loc. Caselle S. Pietro 420, 29017 Fiorenzuola d'Arda - Piacenza

the Certificate No.: **Z01111** for the PROFIBUS Slave:

Model Name: **F02-PremiTork_DPV1**
Revision: **SW/FW: SW=0.00; HW: DE5687 rev.0.0**
GSD: **F02_09E3.gsd, Release 0.0; GSD_Revision 4**

This certificate confirms that the product has successfully passed the certification tests with the following scope:

☑ DP-V0	MS0, Sync, Freeze, Fail_safe
☑ DP-V1	MS2
☑ Physical Layer	RS485

Test Report Number: **PCN066-DPS-01**
Authorized Test Laboratory: **PROCENTEC, Wateringen, The Netherlands**

The tests were executed in accordance with the following documents:
"Test Specifications for PROFIBUS DP Slaves, Version 2.3", March 2004.
This certificate is granted according to the document "Framework for testing and certification of PROFIBUS products".
For all products that are placed in circulation by October 12, 2011 the certificate is valid for life.

(Official in Charge)

Board of PROFIBUS Nutzerorganisation e. V.

(K.-P. Lindner) (Prof. K. Bender)